



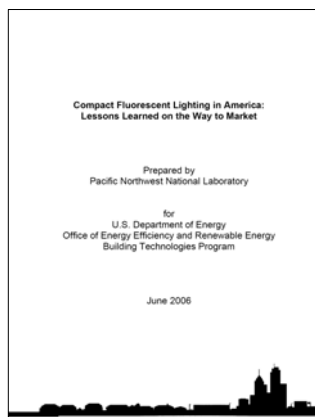
DOE's 5-Year SSL Commercialization Support Plan

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SSL Lessons from CFL Market Introduction?

- Compact Fluorescent Lighting in America: Lessons Learned on the Way to Market
 - Prepared for U.S. DOE by PNNL
 - LJ Sandahl, et al.
 - June 2006
 - <http://www.netl.doe.gov/ssl/publications.html>





Early Fluorescent Lamp Days (Pre-CFL)

- Green tint due to use of halophosphors
- Harsh, unattractive
- Reputation persists
- Carried over to CFLs



“Harsh fluorescent lighting, linoleum floors and regular plaster walls are not ideal surroundings for neonatal intensive care units.” – Google Search.



Early CFLs

- Too big
- Too heavy
- Buzz and flicker
- Poor cold weather performance
- Poor color quality (high CCT, low CRI)
- High prices (\$25 - \$35 in 1980s)





Key Take Away from CFL Experience

- Early consumer experience with fluorescent lamps and CFLs still defines attitudes towards CFLs, even though the technology has greatly improved since its introduction



5-Year SSL Plan Purpose

1. *Affect the types* of products adopted by the market
2. *Accelerate commercial adoption* of products
3. Support applications that *maximize energy savings*

Plan Scope

FY08 to FY12 ♦ general Illumination SSL luminaires



Goals: By FY12

1. **Products Brought to Market:**

Warm White Products

1. 68 lm/W luminaire efficacy
2. 85 CRI (or similar for revised metric)
3. 3500 CCT or less

Cool White Products

1. 88 lm/W luminaire efficacy
2. 70 CRI (or similar for revised metric)
3. 6500 CCT or less

2. **Market Adoption:** 1 million units/year (ENERGY STAR)

3. **Energy Savings:** 230 GWh per year

7



Primary Market Barriers

- High costs
- Lack of industry standards and test procedures
- Lack of information

Note: *Barriers do not address technical barriers, which are being addressed in R&D program.*

8



Market Needs (to address Barriers)

- Effective product purchasing and architectural design guidance
- State of the art products and lighting designs
- Highly visible examples of model SSL general illumination applications
- Independent performance test results on commercial products
- Objective technical information from a credible source
- Industry standards and test procedures for SSL general illumination products
- Coordination of local, regional, and federal SSL commercialization activities

9



DOE SSL Commercialization Support Strategy Elements

1. Buyer Guidance
 - ENERGY STAR
 - Design Guidance
2. Design Competitions
 - Lighting for Tomorrow (Residential Fixtures)
 - Commercial Fixture Design Competition
 - Architectural Lighting Design Competition
3. Technology Demonstrations/Procurements
 - Demonstrations of Market Readiness
 - Demonstrations to Test Field Performance

10



DOE SSL Commercialization Support Strategy Elements (cont.)

4. Commercial Product Testing Program
5. Technical Information
 - Technical Information Development & Dissemination
 - Technical Information Network
6. Standards and Test Procedures Support
7. Coordination and Leadership
 - Facilitating & Coordinating Local and Regional Efforts
 - Federal Government Leadership

11



1) Buyer Guidance

- Developed draft ENERGY STAR criteria for SSL luminaires
- General illumination only
- Residential and commercial products
- Intended to provide early market presence
- 1st draft issued in December 06
- Stakeholder workshop on February 8, 2007 in DC
- 2nd draft issued in April 07; final by June 07



12



Why ENERGY STAR SSL? Why Now?

- Many new products entering market
- Many appear to have greatly exaggerated performance
- DOE SSL commercial product testing is showing actual performance is much less than claimed



Example: Downlight claimed 40 lm/W; measured luminaire efficacy of 13 lm/W and 193 lumens; less than 1/2 the efficacy of typical CFL downlight, and ~1/3 the lumens.

13



Why ENERGY STAR SSL? Why Now?

- Meanwhile, LED technology is rapidly improving
- Manufacturers are announcing new performance records almost every month
 - Nichia announced 150 lm/W @ 20 mA in December (lab)
 - Seoul Semiconductor announced 100 lm/W @ 350 mA in December (commercial)
 - Lumileds announced 115 lm/W @ 350 mA in January (commercial)

Note: the above performance levels are typically done at 25°C for 25 ms with non-standard test; they are not meant to represent actual performance in a luminaire

14



Design Guidance

- Develop SSL design guidance in cooperation with IESNA
- Purpose: provide lighting designers with key information on SSL technology & characteristics to be considered in designs
- Project in development



15



2) Design Competitions

- Lighting for Tomorrow
 - Partnership with ALA and CEE approved through 2008
 - Niche applications
 - Cutting edge design
 - Residential products only
 - Recently expanded to include SSL
 - Expert judges
 - Publicity, visibility for winners



16



Design Competitions (cont.)

- New commercial luminaires design competition being considered
- Also considering SSL architectural design competition in future
- New competitions being discussed with IES

17



3) Technology Demonstrations/ Procurements

- **Purpose:** Demonstrate advanced technology in general illumination applications for visibility & improved understanding
- Leverage demos with closely linked promotional/procurement effort
- Two types of demos:
 - Market readiness
 - Field test

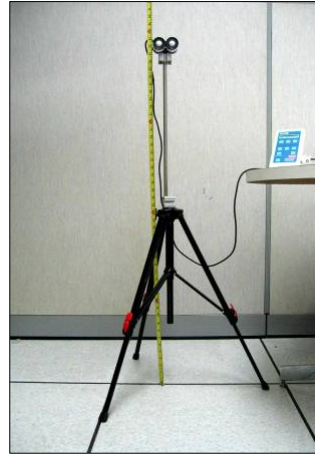


18



Technology Demonstrations

- 1st Round started
- Invitation issued to manufacturers in March
- DOE finds partners & host sites, conducts testing, publicizes results and helps promote follow-up sales
- Evaluations to focus on light quality, occupant responses
- Next round likely before FY end

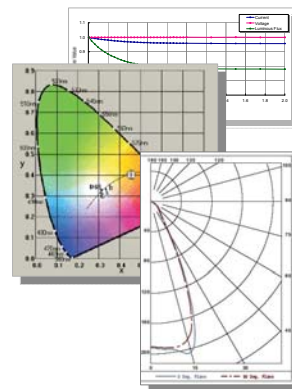


19



4) Commercial Product Testing Program

- Commercially-available SSL products for the general illumination market
 - Luminaires (white light)
 - Indoor and outdoor
 - Residential and commercial
- Testing for
 - Luminaire light output, efficacy
 - Power, thermal characteristics
 - Beam and intensity
 - Lumen depreciation
 - Spectral power distribution, CCT, CRI
 - Benchmarking (other light sources)



20

5) Technical Information

[illegible]

Technical Information Network

- Cooperative agreements to be awarded to selected partners: (CEE and NEEP)
- Outreach to efficiency orgs, utilities, and their contractors
- Leverage existing programs & contacts
- Quarterly meetings
- Disseminate information to:
 - Retailers, builders
 - Consumers, others

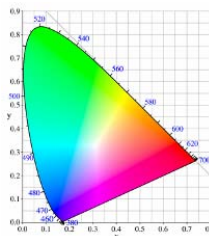




6) Standards & Test Procedures Support

Key Measurement Issues:

- Measurement of luminous flux
 - Luminous efficacy
 - Luminaire efficacy
- Chromaticity and color rendering
- Electrical characteristics
- Drivers
- Life rating (lumen maintenance)
- Definitions and nomenclature



23



Standards and Test Procedures Support



American National Standards Institute



Underwriters
Laboratories Inc.



- DOE workshops in Mar & Oct 2006
- In process:
 - Photometric Measurement (LM-79)
 - Lumen Depreciation (LM-80)
 - Chromaticity (ANSI C78.377A)
 - Electrical performance (ANSI C78.XX3)
 - SSL-LED power supply (ANSI C82.XX1)
 - Definitions/nomenclature (IESNA RP-16)
- New standards before end of 2007

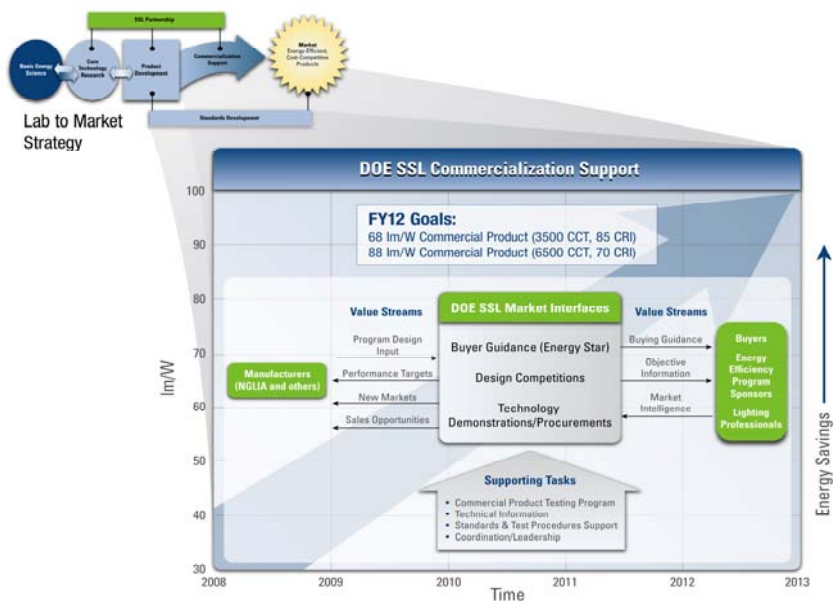
24



7) Coordination & Leadership

- Federal government is largest U.S. energy consumer
 - Working with FEMP to identify opportunities for early SSL applications
- Organize workshops, joint projects for key partners, including
 - Efficiency organizations, utilities
 - Lighting industry professionals
 - Fixture manufacturers

25



26



DOE Solid-State Lighting Website

- Current information on SSL program, progress, and events
- SSL publications: roadmaps, reports, technical fact sheets
- Solicitations
- Register for ongoing SSL UPDATES at:
www.netl.doe.gov/ssl

